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Conservation status of Italian coastal dune habitats in the light of the 4th Monitoring Report (92/43/EEC Habitats Directive)

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Abstract

Coastal dunes are among habitats with the worst conservation status on a global, European and national scale. Monitoring and reporting are of strategic importance to determine the effectiveness of the implementation of Habitats Directive and to preserve the unique biodiversity heritage of the Italian dunes. In this study we show main results of the 4th National Report with specific reference to the macro-habitat "Coastal Sand Dunes and Inland Dunes", highlighting its updated current conservation status at the national and Biogeographical level. A comprehensive Working Group of territorial experts collected, updated, validated and integrated the data available for 11 Annex I Habitats, distributed in the Alpine, Continental and Mediterranean Biogeographical Regions. The conservation status was evaluated through the following criteria: geographic range, surface area, structure, functions, pressures, threats, conservation measures and prospects. Results highlighted the dramatically bad conservation status of Italian dune Habitats: the overall assessment reported 88% of habitats in bad conservation status and the remaining 12% is in inadequate conditions. Results showed a generalised threat and a worrying conservation status both on herbaceous and wooded communities, in particular in some relevant habitats, such as the shifting dunes. Main pressures and threats were linked to residential, commercial and industrial activities, as well as alien species. Although some of the changes in distribution and trends are probably deriving from more accurate and updated data, the alarming conservation status of Italian sand dunes requires a better knowledge of pressures and threats for further management actions and monitoring plans, inside and outside protected areas.

Keywords

Continental Biogeographical Region, European guidelines, Mediterranean Biogeographical Region, national report, psammophilous vegetation, threats

Introduction

Sandy coastlines and dune ecosystems are fragile environments currently exposed to several pressures and particularly threatened at a global, European and national scale (Acosta et al. 2009; Feola et al. 2011; Prisco et al. 2013; Genovesi et al. 2014; Janssen et al. 2016; Gigante et al. 2018). Although the degradation and loss of dune systems

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affect many countries all over the world, it is particularly intense along the Mediterranean coasts.

The Mediterranean basin is one of the world biodiversity hotspots (Myers et al. 2000), but, at the same time, it is one of the regions of the world subjected to the highest level of historical anthropic pressure (Newton et al. 2012; Anthony 2014). Indeed, more than 450 million inhabitants currently live in the Mediterranean countries, and especially near the coasts (UNEP/MAP 2012). The high population density along the Mediterranean shorelines represents a major threat to coastal sand dunes, which suffer from unregulated urbanization, intensive farming, infrastructures, massive bathing tourism, pollution, biological invasions and over-exploitation of the natural resources (Buffa et al. 2007, 2012; Malavasi et al. 2013, 2016; Basnou et al. 2015; Del Vecchio et al. 2015; Sciandrello et al. 2015; Poeta et al. 2017; Nordhaus et al. 2018; Sperandii et al. 2018; Giulio et al. 2020). In Italy, previous studies reported that coastal sand dunes are among the habitats with the worst conservation status, therefore, the unique biodiversity heritage along the Italian coasts needs to be preserved for the future generations and its protection should represent a priority both at national and European level.

In the last years, we have witnessed a growing global awareness concerning habitat monitoring and conservation; habitats as a whole are probably more useful indicators of ecosystem functioning compared to individual species (Balmford et al. 2002; Cowling et al. 2004; Bunce et al. 2013; Gigante et al. 2016a). The protection of biodiversity requires a constant and rigorous technical-scientific commitment at national level, which should also be extended to the obligations deriving from community rules. In particular, the Habitats Directive (92/43/EEC) requires the Member States to implement surveillance on the conservation status of habitats and species of Community Interest, taking into account also the most important threat factors that influence their future prospects (Angelini et al. 2016; Gigante et al. 2016b).

In 2016, the first European Red List of Habitats had been published. Traditionally, the Red Lists, based on criteria developed by the International Union for Conservation of Nature (IUCN), have always focused on single species with extinction risk and trends evaluated at the *taxa* level. The European Red List of Habitats represents a step further since plant communities and habitats have been taken into account as assessment units. This Red List confirms not only the key role of habitats concerning the implementation of conservation strategies and priorities, but also the necessity of monitoring at the ecosystem level (Rodwell et al. 2013; Keith et al. 2013, 2017; Janssen et al. 2016; IUCN 2016; Gigante et al. 2018).

Monitoring and reporting are of strategic importance to determine the effectiveness of the implementation of the Community Directives on biodiversity. Moreover, they serve as a reference framework to identify priorities and critical issues for the next monitoring period (Genovesi et al. 2014).

In this frame, based on the European guidelines (Evans and Arvela 2011), a technical manual for habitat monitoring has been produced at the national level in Italy. This manual provides practical standardised monitoring tools particularly tuned to the Italian ecological and biogeographical characteristics and peculiarities, standing as an official reference for fulfilling the monitoring obligations imposed by the Habitats Directive (Angelini et al. 2016; Gigante et al. 2016b). Major goals of the Habitats Directive are achieved through the technical reports on the conservation status of Habitats listed in Annex I (Dir. 92/43/EEC) and on conservation measures implemented in accordance with article 17. Reporting is requested every six years to each Member States and in 2019 Italy, just like the other EU27 countries, has delivered its 4th National Report referred to the period 2013-2018. The here collected and processed information represents the most updated picture of the conservation status of habitats and species of Community Interest in the whole Italian territory. The complete set of rough data is available on the Eionet Central Data Repository (2018).

The activities for the preparation of the 4th National Report have been coordinated by the Italian Institute for Environmental Protection and Research (ISPRA) on behalf of the Ministry for Environment, Land and Sea Protection (MATTM), with the scientific support of the Italian Botanical Society (SBI) and the Italian Society of Vegetation Science (SISV). Between October 2018 and May 2019, a comprehensive Working Group of territorial experts distributed by administrative regions and macro-habitat categories, worked in synergy with ISPRA itself and, where possible, with regional administrations, in order to collect, analyse and validate all the available data concerning the 124 types of terrestrial and inland water Habitats present in Italy (Gigante et al. 2019). Through a complex and multi-level teamwork and by comparing the results of the previous reporting period (2007-2012), it was possible to assess the current conservation status of each habitat at biogeographical scale and therefore to fill out the standard European assessment sheets.

As part of the results achieved by the Working Group, this paper aims at presenting the major results of the 4th National Habitat reporting for the macro-habitat type "Coastal Sand Dunes and Inland Dunes". Specifically, we reported the updated conservation status of each coastal dune habitat at national level with reference to Biogeographical Regions.

Materials and Methods

The macro-habitat type "Coastal Sand Dunes and Inland Dunes" encompasses 21 Annex I Habitats in Europe, 11 of which have been reported in Italy. Out of these 11 habitats, 10 are coastal habitats occurring in the Continental and Mediterranean Biogeographical Regions, while only the inland dunes (Habitat 2330) is a non-coastal habitat

occurring in the Continental and (marginally) Alpine Biogeographical Region (Table 1). The reporting activities led to the compilation of 19 assessment sheets, with the new inclusion of two marginal types which had not been evaluated in the 3rd Report due to a lack of robust data at that time (Genovesi et al. 2014). Among the 19 assessment sheets, one pertained to the Alpine Region, 10 to the Continental Region and 8 to the Mediterranean Region (Table 1).

Data collection and analysis

The first step was the collection and integration of data available for reporting: information provided by administrative regions and autonomous provinces (centralised by ISPRA; hereafter: "collected data") and further data deriving from the latest available updates of the Natura 2000 sites Standard Data Forms. These data were organised at two different levels: I) National scale, through the implementation of distribution maps; II) Biogeographic Regions, which is the scale of the final assessment (Gigante et al. 2019). In addition to the material provided by local administrations, we included the official data available on the MATTM and EEA (European Environmental Agency) websites.

A critical review and analysis of the collected data were necessary, mainly due to their heterogeneity and incompleteness. In some cases, the administrative regions provided incomplete data (e.g. surface area of the habitat missing, incomplete indication regarding the conservation measures applied) or they provided data in a different format than allowed (e.g. surface area in hectares instead of km^2, cartographic files with no spatial reference, etc.). Therefore, a comprehensive scientific exchange within and between the macro-habitats Working Group and Subgroups was carried out, which finally led to shared and methodologically sound solutions to fill gaps and discrepancies emerged. The missing data were initially requested to the involved administrative regions and then integrated through the official information hold in the Natura 2000 sites Standard Data Forms, data gathered in published material, "gray" literature, unpublished data of specialists and all sources deemed useful to provide an updated picture on the current conservation status of the Habitats. The data received in different formats were also homogenised.

At the same time, an all-embracing analysis of the information was carried out with the scope to update the geographic distribution of Habitats at the national level. We used the maps of the 3rd Report as starting background information, based on the European 10 km x10 km cells grid, Reference System ETRS89-LAEA5210. In each grid cell, the collected data on Habitats occurrence were validated, integrated or modified taking into account different sources such as official maps, scientific papers, published books, phytosociological tables or direct field surveys, combined with the expert knowledge of the Working Group. In particular, the major contribution to the data implementation derived from the most recent scientific publications on dune systems and related topics with reference, at least in part, to the Italian territory (Buffa et al. 2007, 2012; Viciani et al. 2007; Gamper et al. 2008; Sburlino et al. 2008, 2013; Prisco et al. 2012; Minissale and Sciandrello 2013, 2015, 2017; Pisanu et al. 2014; Sciandrello et al. 2015, 2017; Gheza et al. 2016; Silan et al. 2017; Tomaselli and Sciandrello 2017; Angiolini et al. 2018; Bonari et al. 2018; Del Vecchio et al. 2018; Marcenò et al. 2018).

Finally, extensive cross-check work allowed the development of a comprehensive biogeographic database. This database includes for each cell the information originally derived from the 3rd Report, updated and verified by regions, autonomous provinces or territorial experts, using explicit data or confirmed by direct verification. In this way, new occurrences were added only when supported by authoritative sources. We should point out that we proceeded to delete presences in cases they were not justified or clearly incorrect, always including a valid motivation. In the absence of any updated information, we confirmed data from the 3rd Report as provided by the administrative regions.

All data supporting the Habitats' distribution and characteristics (georeferenced phytosociological relevés, both

Table 1. List of the evaluated coastal sand dunes and inland dunes Habitats and their presence in the Italian Biogeographical Regions: Alpine (ALP), Continental (CON) and Mediterranean (MED).

HABITATS (Group 2xxx)	Biogeographic Regions		
	ALP	CON	MED
2110 Embryonic shifting dunes		X	X
2120 Shifting dunes along the shoreline with *Ammophila arenaria*		X	X
2130 Fixed coastal dunes with herbaceous vegetation		X	
2160 Dunes with *Hippophae rhamnoides*		X	
2210 *Crucianellion maritimae* fixed beach dunes			X
2230 *Malcolmietalia* dune grasslands		X	X
2240 *Brachypodietalia* dune grasslands with annuals		MARGINAL	X
2250 Coastal dunes with *Juniperus* spp.		X	X
2260 *Cisto-Lavanduletalia* dune sclerophyllous scrubs		X	X
2270 Wooded dunes with *Pinus pinea* and/or *Pinus pinaster*		X	X
2330 Inland dunes with open *Corynephorus* and *Agrostis* grasslands	MARGINAL	X	

published and unpublished) are currently being archived in the National Database of phytosociological surveys VegItaly (Gigante et al. 2012; Landucci et al. 2012), freely accessible online and managed by the Italian Society of Vegetation Science (Gigante et al. 2019).

Assessment criteria for Annex I Habitat reporting

The standard European assessment sheets for Habitats reporting foresee several criteria that must be considered in order to assess the final conservation status. Criteria were derived from the European guidelines (Evans and Arvela 2011) and encompass the seven points listed below.

- Range: provides the range surface area (expressed as the area of 10 km × 10 km cells) of the outer limits of the habitat distribution and can be considered as an envelope including the areas of actual occurrence; it was calculated by applying a standardised algorithm to the distribution map of the habitat, by using the Range tool (Eionet Central Data Repository 2019).
- Area covered by the habitat type: provides the total area (in km^2) currently occupied by the habitat at biogeographical level.
- Structure and functions: provides the area (in km^2) of the habitat with good, not-good and unknown condition, considering both abiotic and biotic factors; when missing, we deduced this information from the data reported in the Standard Data Forms of Natura 2000 sites. An updated list of habitat-specific typical species was also delivered, based on the indications provided by Angelini et al. (2016).
- Main pressures and threats: provides a list of pressures (impact on the long-term) and threats (future/foreseeable effects) with a ranking of their impacts on the conservation status of each habitat; pressures and threats were weighted according to their frequency and importance on the biogeographical scale. We referred to the official list of pressures and threats adopted by Eionet and IUCN, based on Salafsky et al. (2008).
- Conservation measures: in this case, we implemented the data provided by the administrative regions with information deriving from the existing Natura 2000 management plans.
- Future prospects indicate the direction of expected changes in conservation status in the near future; we combined current status, reported pressures and threats, and existing conservation measures with reference to range, area, structure and functions.
- Overall assessment: indicates the conservation status at the end of the reporting period. It represents the combination of the assessments for each single parameter (range, area, structure and functions, future prospects, overall trend), with reference to the four different categories: Favourable (FV), Unfavourable-Inadequate (U1), Unfavourable-Bad (U2) and Unknown (XX).

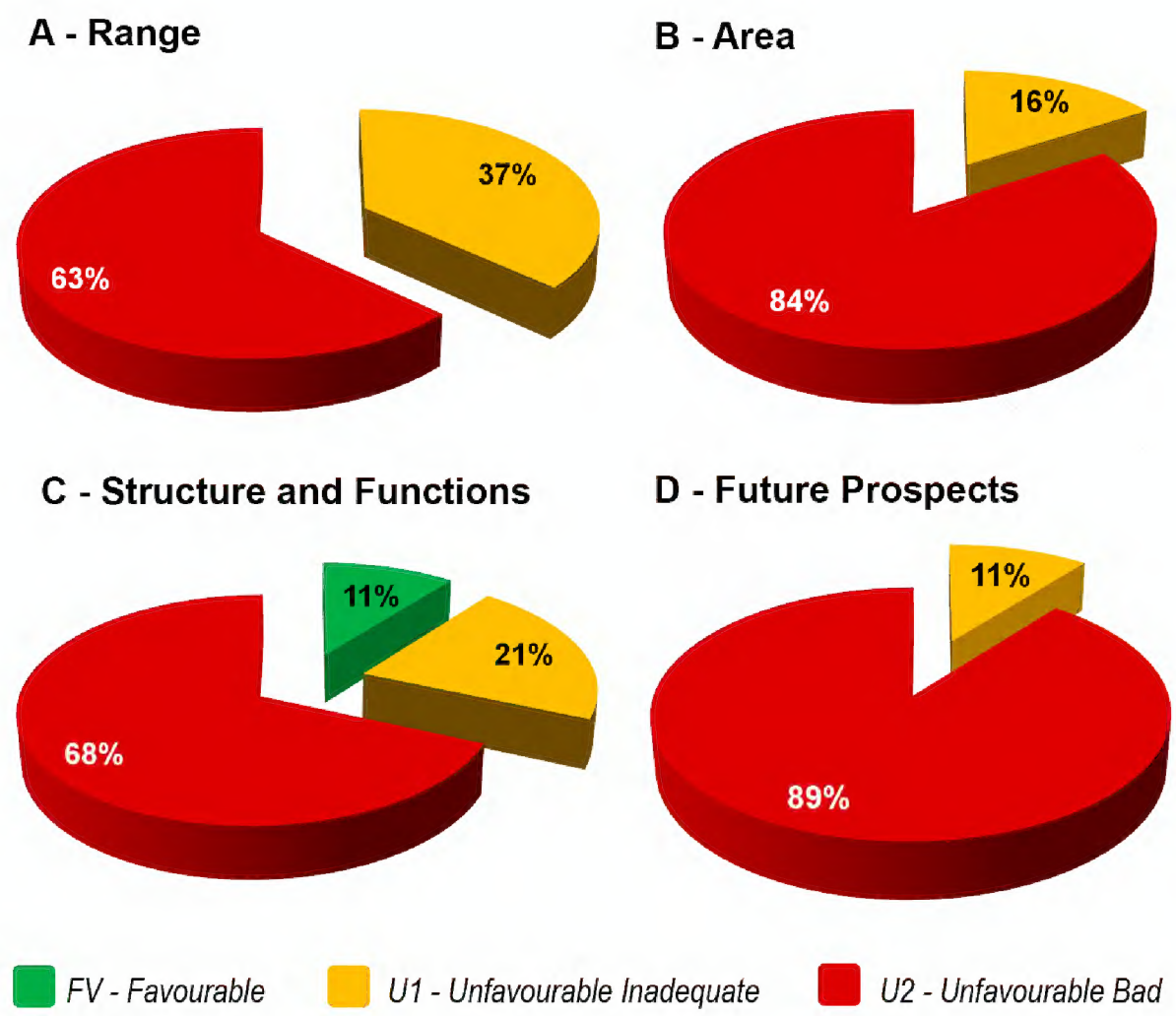

Figure 1. Percentage of the Italian coastal sand dunes and inland dunes Habitats in each assessment category (FV, U1, U2) based on the criteria: A Range, B Area, C Structure and functions, D Future prospects.

Results

Range, area, structure and functions and future prospects criteria

For the range criterion, 63% of the assessed Habitats is in Unfavourable-Bad conservation status (U2, Fig. 1A) while about 37% is in Unfavourable-Inadequate (U1) conservation status. Habitats in the worst conditions are mainly located in the Continental Biogeographical Region.

Regarding the total area currently occupied, almost all Habitats (84%) are in an Unfavourable-Bad conservation status (U2, Fig. 1B); the only habitat in the U1 category is the wooded dunes with *Pinus* species (2270).

Considering structure and functions, about 68% of the Habitats is in Unfavourable-Bad (U2) conservation status and includes embryo and shifting dunes (Habitats 2110 and 2120), fixed dunes (Habitat 2130, Continental Region), dune grasslands (Habitats 2210, 2230 and 2240 in both Biogeographical Regions) and dunes with *Juniperus* species (Habitat 2250, Continental Region), while 21% of Habitats are in Unfavourable-Inadequate (U1) conservation status; however, the wooded dunes with *Pinus* species (Habitat 2270) show a Favourable habitat quality (FV, Fig. 1C).

The future prospects of the major part of the habitats are definitely Unfavourable-Bad (U2, 89%). Only the wooded dunes with *Pinus* species are considered with Unfavourable-Inadequate (U1) conservation status (Fig. 1D).

In order to highlight the variation of the conservation status in relation with the area of the Habitats, for each Biogeographic Region we gathered those with similar surface area and then analysed how the previous assessments were distributed in each surface class (< 25 km², between 25 and 50 km², > 50 km²). The highest occurrence of Unfavourable-Bad conservation conditions (U2) affects especially Habitats with less than 25 km² of extent in the Continental Region (Fig. 2). Similar trends could be observed for Mediterranean Habitats with a surface between 25 and 50 km². On the other hand, Habitats with Favourable (FV) or Unfavourable-Inadequate (U1) conservation status are mainly the woody ones on stabilised dunes (Habitat 2270 and 2260).

We should highlight that the key dune habitat 2120 (Shifting dunes with *Ammophila arenaria*) has an Unfavourable-Bad conservation status (U2) for all the criteria in both Biogeographical Regions. In the Continental Region, Habitats with all U2 assessments are the fixed dunes with herbaceous vegetation (Habitat 2130), the dune grasslands (Habitat 2230) and the inland dunes (Habitat 2330); the latter has an Unfavourable-Bad conservation status for all the criteria also in the Alpine Region. In the Mediterranean Region, Habitats with all U2 assessments are the dune with *Juniperus* species (Habitat 2250) and the maquis with sclerophyllous scrubs (Habitat 2260).

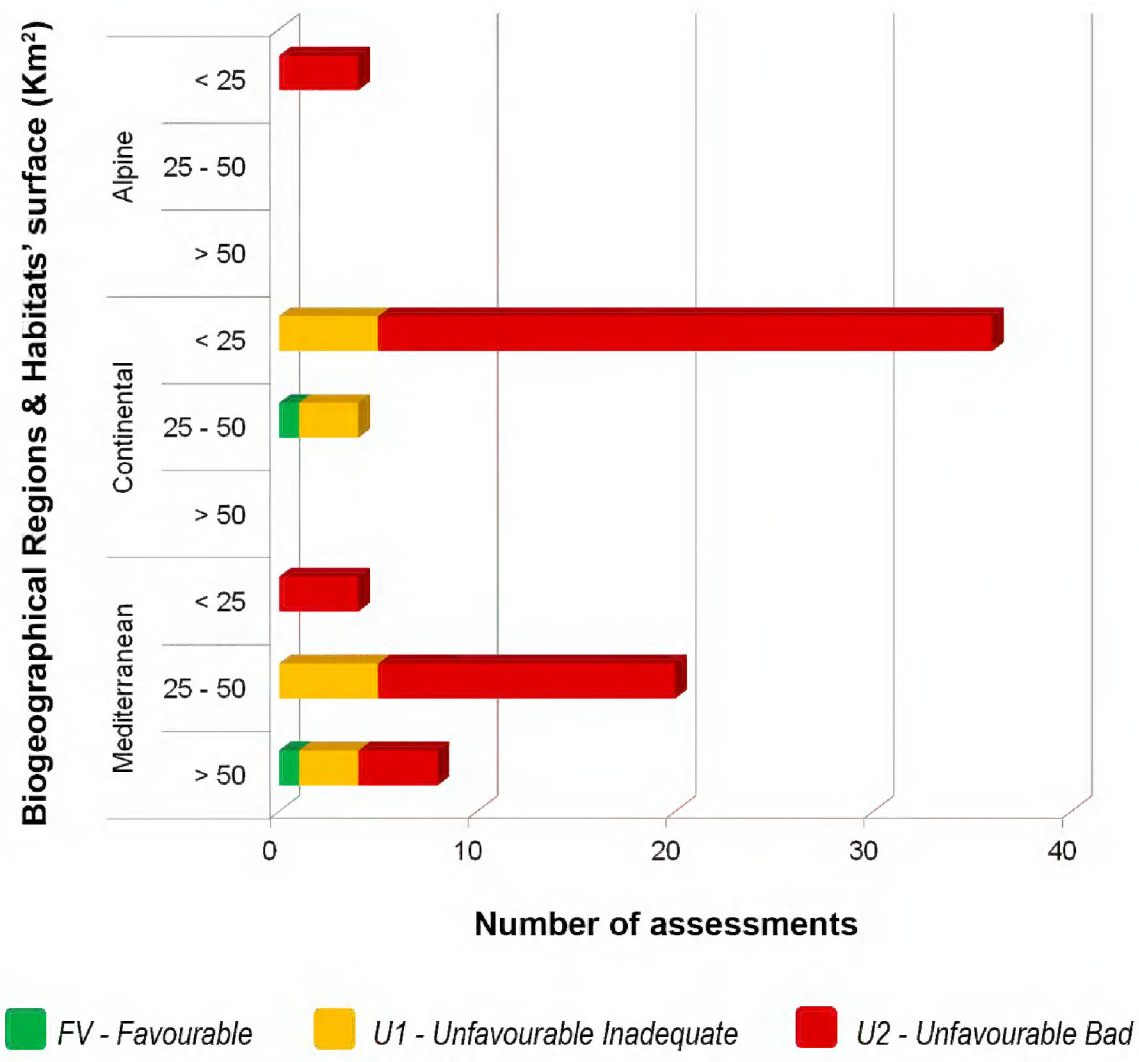

Figure 2. Total number of assessment in each category (FV, U1, U2) disaggregated by Biogeographical Region and surface area (km²) of the Italian coastal sand dunes and inland dunes Habitats. We summed up the results of all criteria considered for the assessment: range, area, structure and functions, future prospects.

Main pressures, threats and conservation measures

Among the main pressures (P) and threats (T) observed in the assessments, most of them are directly or indirectly related to human activities:

- Development, construction and use of residential, commercial, industrial and infrastructure areas (P 34% – T 36%), in all habitats, in at least one administrative region;
- Alien and problematic species (P 17% - T 17%), in all habitats, in at least one administrative region.

However, others could also be associated with natural process, particularly coastal erosion:

- Natural processes (P 11% - T 10%), in almost all habitats except dune grasslands and fixed dunes.

Concerning the conservation measures adopted by the administrative regions to limit the negative impact of pressures and threats, we could highlight:

- Measures related to residential, commercial, industrial and recreational infrastructures, operations and activities (39%), in almost all habitats in at least one administrative region;
- Measures related to alien and problematic native species (22%), in almost all habitats except fixed and wooded dunes;
- Measures related to natural processes, geological events and natural catastrophes (10%), in about half of the habitats, mainly in the Mediterranean Region.

Overall conservation status and trend

As it could be envisaged from previous results, the overall assessment of Dune Habitats at the end of the 4th reporting period is clearly Unfavourable-Bad (U2) for about 90% of the assessed Habitats (Fig. 3A), and the trend with reference to the last reporting cycle is deteriorating for almost 70% of Habitats (Fig. 3B). Only 21% of Habitats could be considered in a stable trend, mostly represented by woody habitats on fixed dunes.

The reported unknown trend is referred to the two marginal Habitats that have been evaluated for the first time in this report (see Table 1).

Although more than half of Habitats showed a considerable change in the overall conservation status compared to the previous Report, it is worth pointing out that probably a consistent part of this degradation process is related to a better knowledge of the distribution and quality of Habitats. However, we could not exclude an actual deterioration of the conservation status for some habitats, such as the Mediterranean dune grasslands (Habitat 2230).

The complete set of data relating to all the criteria used for assessing the conservation status of the Habitats are available on the Article 17 Web Tool (European Topic Centre on Biological Diversity 2019).

Trends in the last reporting cycles

If we consider the trend across the last three reporting cycles (Table 2), we note a gradual improvement in knowledge concerning the Habitats conservation status, which led to a better definition of all the assessments, from unknown (or data deficient) to more clear categories. At the same time, Habitats in Favourable (FV) and Unfavourable-Inadequate conservation status (U1) have progressively reduced and in the last Report the large majority of the Italian dune Habitats show an Unfavourable-Bad conservation status (U2) (Table 2).

Discussion

The valuable ecological diversity and the multiple ecosystem services associated to dune habitats have been progressively threatened by the expansion of anthropic activities and also by natural factors, making coastal dunes among the most threatened ecosystems at the global and local scale (Schlacher et al. 2007; Defeo et al. 2009; Prisco et al. 2015, 2016a; Acosta and Ercole 2015; Sciandrello et al. 2015; Janssen et al. 2016; Malavasi et al. 2016; Marcenò et al. 2018; Sarmati et al. 2019; Carranza et al. 2020). Although the Italian shoreline still hosts several of well-preserved stretches of sandy dunes, the 4th monitoring Report just completed has clearly highlighted the alarming bad or inadequate conservation status of most dune habitats in Italy.

One of the greatest threats is related to their limited geographical extent which, with a continuously decreasing trend over the years, will lead to an increasingly worse future scenario. The most affected Habitats are those with the minimum extension, which are mainly concentrated in the Continental Region, but also in the Mediterranean one (shifting dunes, fixed dunes, dunes with *Hippophae rhamnoides*, dune grasslands, dunes with *Juniperus* species, maquis with sclerophyllous scrubs, inland dunes). Moreover, our results showed that both herbaceous and wooded Habitats are highly threatened. In particular, we should highlight the worrying conservation state of some relevant dune Habitats (e.g. Shifting dunes with *Ammophila arenaria*, Habitat 2120) considered with a key role in some ecosystem services, such as dune stability enhancement, coastal erosion protection, resistance of the coastal dune pollination networks, as well as in providing habitat for coastal fauna and in supporting fungal diversity (Prisco et al. 2016b; Filesi et al. 2017; Fantinato et al. 2018; Konlechner et al. 2019; De Battisti and Griffin 2020). The Habitat 2270 (Wooded dunes with *Pinus* species) is the only one to show at least a favourable criterion (structure

Table 2. Final assessments of the Italian coastal sand dunes and inland dunes Habitats as resulting in the last three reporting cycles, from 2001 to 2018 (FV: Favourable; U1: Unfavourable-Inadequate; U2: Unfavourable-Bad; XX: Unknown; DD: Data Deficient).

HABITAT	2nd Report (2001-2006)			3rd Report (2007-2012)			4th Report (2013-2018)		
	ALP	CON	MED	ALP	CON	MED	ALP	CON	MED
2110 Embryonic shifting dunes		U2	U2		U2	U2		U2	U2
2120 Shifting dunes along the shoreline with *Ammophila arenaria*		U2	U2		U2	U2		U2	U2
2130 Fixed coastal dunes with herbaceous vegetation		U1			U2			U2	
2160 Dunes with *Hippophae rhamnoides*		U1			U2			U2	
2210 *Crucianellion maritimae* fixed beach dunes			U1			U2			U2
2230 *Malcolmietalia* dune grasslands		U1	XX		U2	U1		U2	U2
2240 *Brachypodietalia* dune grasslands with annuals		U1	XX		DD	U1		U2	U2
2250 Coastal dunes with *Juniperus* spp.		U2	U1		U2	U2		U2	U2
2260 *Cisto-Lavanduletalia* dune sclerophyllous scrubs		U2	U1		U2	U2		U2	U2
2270 Wooded dunes with *Pinus pinea* and/or *Pinus pinaster*		FV	FV		FV	U1		U1	U1
2330 Inland dunes with open *Corynephorus* and *Agrostis* grasslands	DD	XX		DD	U2		U2	U2	

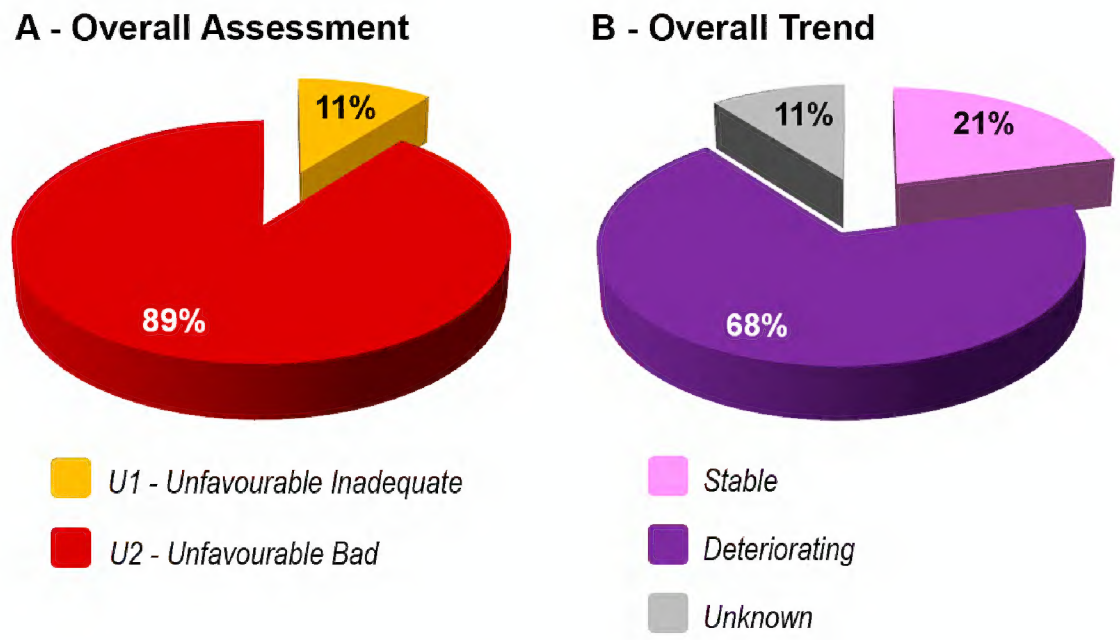

Figure 3. A Final overall assessment and B overall trend in the conservation status of the Italian coastal sand dunes and inland dunes Habitats.

and functions); however, the overall conservation status of this habitat is still inadequate (Bonari et al. 2018). Although wooded dunes are usually found in the inner part of the coastal vegetation zonation, they are often subjected to intense silvicultural treatments and tourists trampling (Sarmati et al. 2019).

The overall worrying state of conservation of the dune systems claims for a better knowledge of pressures and threats acting on these habitats and for further monitoring plans. Without such a systematic approach, coastal dune habitats are going to face further degradation trends in both structure and functions, including also the disruption of spatial zonation of plant communities (Sarmati et al. 2019). This degradation process could finally lead to a dramatic alteration of the ecosystem services they provide (Everard et al. 2010; Barbier et al. 2011; Drius et al. 2019). Additionally, degraded dune habitats are more susceptible to biological invasions (Del Vecchio et al. 2015; Gheza et al. 2018; Giulio et al. 2020).

In dynamic and vulnerable ecosystems such as coastal dunes, successful conservation outcomes in the long-term depend on sound evaluations of the effectiveness of current management measures, supported by regular and highly frequent on-ground monitoring, both inside and outside protected sites. We believe that our results provide bases and useful insights for dune habitats protection and management, in the context of the monitoring and reporting obligations set up by the Habitats Directive.

Overall, the results of the 4th Report testify for better knowledge on the geographical distribution, quality, typical species and conservation status of the whole Italian Habitats at biogeographical scale. Therefore, we should clarify that for dune Habitats, some of the changes in distribution and trends might probably be related to the application of more accurate and updated data. However, even though the geographical distribution maps of these Habitats have been validated by a large group of experts with detailed territorial knowledge, yet the lack of information on the actual location of the Habitats outside the Natura 2000 sites has negatively influenced the quantification of the Range parameter, as well as the structure and functions parameter. Finally, it's worth noting that

the information collected has been structured to ensure the archiving and traceability of both published and unpublished literature, placing a solid base of reliable and verified data at the local scale for the next reporting cycles (Gigante et al. 2019).

Conclusions

According to the 4th Monitoring Report (92/43/EEC Habitats Directive) the conservation status of Italian coastal sand dunes and inland dunes Habitats is dramatically bad: the overall assessment reports 88% of Habitats in a bad conservation status and the remaining 12% in an inadequate condition. Key dune habitats, such as "Shifting dunes with *Ammophila arenaria*", show a bad conservation status for all the considered criteria in both Biogeographical Regions. Main pressures and threats are the development of residential, commercial and industrial areas and the expansion of alien and ruderal species. Results show an overall worse conservation status with respect to previous national reports. Although part of these changes is probably due (but not only) to the provision of more accurate and updated data, the undoubtedly bad conservation status of these unstable but resilient Habitats should draw attention to more effective conservation measures, supported by monitoring activities, both inside and outside protected areas.

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